Mainstem Klamath River Fall Chinook Spawning Survey

Fiscal Year 2001

U.S. Fish and Wildlife Service
Arcata Fish & Wildlife Office
Arcata, California

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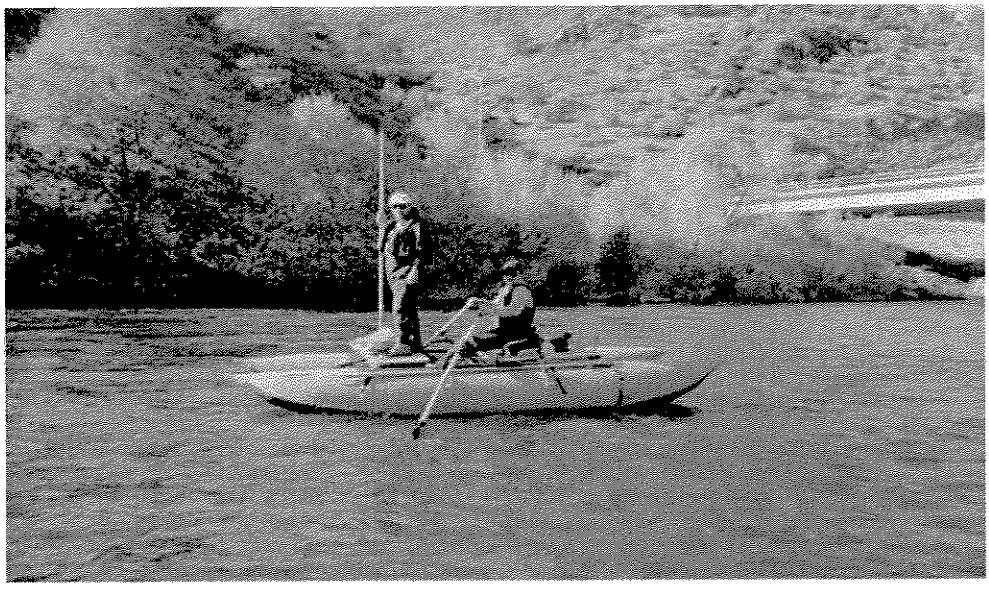

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

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ABSTRACT

This report describes observations and results of the eighth annual U.S. Fish and Wildlife Service fall chinook salmon (*Oncorhynchus tshawytscha*) spawning survey on the mainstem Klamath River. The survey was conducted for six consecutive weeks from October 16 to November 22, 2000, covering 134.8 river kilometers between Iron Gate Dam and the confluence of Indian Creek at Happy Camp. A total of 1,578 redds were observed during the 2000 survey which represents a 62.7% increase from the 1999 redd count, and the first year of increasing redd numbers since 1997.

In 2000, spawning was observed throughout the mainstem Klamath River from Iron Gate Dam to Indian Creek with 49.9% (n=788) of the redds located between Iron Gate Dam and the Shasta River. From 1993 to 1999, the tendency for chinook to spawn within the upper 10 river km (rkm; Iron Gate Dam to Cape Horn Creek), increased from 24.2 to 60.9%, but in 2000 decreased to 37.5%. Redd density in this upper mainstem section was 59.1 redds/rkm. The lowest redd densities in 2000 were between Shinar and China Creek (0.7 redds/rkm). Water clarity between Iron Gate Dam and Indian Creek was 1.2 to 2.0m, and represented some of the lowest recorded for these surveys.

During 2000, only two redds were observed on suction dredge tailings between Iron Gate Dam and Indian Creek.

INTRODUCTION

The Klamath River drains approximately 14,000 km^2 in Oregon and 26,000 km^2 in California. The majority of the watershed in California is within the boundaries of the Six Rivers, Klamath and Shasta-Trinity National Forests. The Yurok Indian Reservation, comprising approximately 139 km^2 in Humboldt and Del Norte counties, borders the lower 68 km of the Klamath River (Figure 1). The most important anadromous salmonid spawning tributaries in the basin include the Trinity River (the largest tributary in the basin) draining approximately 7,690 km^2, and the Shasta, Scott and Salmon rivers, each draining approximately 2,070 km^2. Iron Gate Dam (IGD; rkm 306) on the Klamath River and Lewiston Dam (rkm 249) on the Trinity River represent the upper limits of anadromous salmonid migration in the basin. Iron Gate Hatchery (IGH) and Trinity River Hatchery, located near the base of each dam, were constructed as mitigation for natural fish production losses resulting from each project (USFWS 1991).

The Klamath River Basin has historically supported large runs of chinook salmon (*Oncorhynchus tshawytcha*), coho salmon (*O. kisutch*), and steelhead trout (O. *mykiss*), which have contributed considerably to subsistence, sport and commercial fisheries in California. Generations of Indians have utilized fishing grounds in the drainage, and their fisheries for salmon, steelhead and sturgeon have historically provided the mainstay of the Indian economy in the area. Sport fishing for salmon and steelhead in the drainage may exceed 200,000 angler days annually. During the 1980's, the Klamath River stocks accounted for up to 30% of commercial chinook salmon landings in northern California and Southern Oregon and averaged 450,000 chinook per year (PFMC 1988).

Concern about the depletion of anadromous salmonid resources and associated habitat in the basin emerged around the turn of the century, and has accelerated in recent decades coincident with expanded logging and fishing operations, dam building activity, road construction and other development. As in other river systems of the Pacific Northwest, chinook salmon of the Klamath River Basin have experienced the continued effects of habitat degradation and over-exploitation as reflected by declining runs in recent decades (USFWS 1991).

On October 27, 1986 the Congress enacted P.L. 99-552, the Klamath River Fish and Wildlife Restoration Act. This action authorized the Secretary of the Interior to restore the anadromous fish populations to optimum levels in both the Klamath and Trinity Rivers through a habitat restoration program and formation of the Klamath River Fishery Management Council (USFWS 1991).

The U.S. Fish and Wildlife Service (USFWS) was funded through the Klamath River Fish and Wildlife Restoration Program to identify fall chinook spawning areas and collect information necessary to estimate the natural fall chinook spawning escapement on the mainstem Klamath River between IGD and the confluence of Indian Creek. This information is critical for the evaluation of instream flow and harvest management alternatives.

MATERIALS AND METHODS

Survey Procedures

The Arcata Fish and Wildlife Office (AFWO) mainstem Klamath River redd survey protocol consisted of six mainstem reaches (Figure 2) covering 134.8 rkm (83.8 river miles). The six reaches were surveyed weekly from IGD to the confluence of Indian Creek, unless adverse weather limited the visibility of the water to less than one meter in depth. Each crew covered the same survey reaches each week to remain familiar with each survey reach and prior redd locations.

Figure 1. Overview map of the Klamath River Basin accessible to anadromous fish.

Figure 2. Mainstem Klamath River chinook spawning survey project location including individual study reaches (1 to 6).

Rafting Equipment

Two 4.57 m (15 foot) inflatable Wing Catarafts were used for direct observation of fall chinook salmon redds. These rafts were noted for use in white water rescue due to their stability and maneuverability in fast water. The rafts were stacked on a flat trailer and deployed at selected access sites along the study area. Each raft was equipped with a rowing frame, a modified observation platform, and anchoring system. Two personnel operated each raft (rower and observer).

Survey Equipment

Plastic survey flagging tape was used to mark individual redds and redd clusters along the river bank in each reach. Polarized sunglasses and baseball style caps were used to reduce glare and improve visibility into the water. A removable wooden measuring rod (2.4 m) was mounted upright on each cataraft to help observers balance while standing up and to measure redds. During the fifth (November 13 to 17) and sixth week (November 20 to 22) of the survey, crews marked the location of individual and redd clusters with a Rockwell International, Precision Global Positioning System Receiver (GPS).

Reaches 1 to 6

Reach 1: IGD river access (rkm 306.1) to Ash Creek river access (rkm 281.6; Figure 2).

Reach 1 is approximately 24.5 rkm (15.2 miles) in length and was surveyed over a period of two days

(Monday and Tuesday). Due to the high percentage of redds in Reach 1, two cataraft crews surveyed the entire reach from IGD to Deliverance Camp river access (rkm 283.1). One crew surveyed the left bank to mid-channel while the second crew surveyed from the right bank to mid-channel. A section of Reach 1 from the Interstate 5 (I-5) bridge (rkm 288.4) to the Deliverance Camp river access (rkm 283.1) was completed in approximately two hours on the first day (Monday) during weeks 1 to 6. The section from Deliverance Camp river access to Ash Creek river access (rkm 281.6) was not surveyed because past surveys have revealed no redds (probably from a lack of spawning habitat). On the second day (Tuesday), the survey resumed from the IGD river access to the I-5 bridge. This stretch was completed in eight to ten hours and was surveyed each week for 6 consecutive weeks. This stretch was surveyed the sixth week to finish recording redd locations with a GPS.

Reach 2: Ash Creek river access to Beaver Creek riffle river access (rkm 257.1; Figure 2).

Reach 2 is approximately 24.5 rkm (15.2 miles) in length. The Beaver Creek riffle river access is located along the right bank on a large gravel bar downstream from Beaver Creek bridge, just off Highway 96. One crew surveyed this reach, on the third day (Wednesday) in approximately seven hours. Reach 2 was surveyed each week for five consecutive weeks.

Reach 3: Beaver Creek river access to Blue Heron river access (rkm 230.0; Figure 2).

Reach 3 is approximately 27.1 rkm (16.2 miles) in length. The Blue Heron river access is approximately 2 rkm upstream from the Scott River confluence. This reach was surveyed by one crew on the third day (Wednesday) in approximately eight hours. Reach 2 was surveyed each week for five consecutive weeks.

Reach 4: Blue Heron river access to Seiad Bar river access (rkm 211.2; Figure 2).

Reach 4 is approximately 18.8 rkm (11.3 miles) in length. The Seiad Bar river access is located along the right bank of the Klamath River. River access was acquired approximately 2.7 rkm downstream of the access point used in past spawner surveys. The river access is acquired by taking the road to the right of the California Department of Transportation's compound. The reach boundaries remain the same as those from
past years. This reach was surveyed on the fourth day (Thursday), by one crew, in approximately eight hours. Reach 4 was surveyed each week for five consecutive weeks.

Reach 5: Seiad Bar river access to China Point river access (rkm 188.5; Figure 2).

Reach 5 is approximately 22.7 rkm (13.6 miles) in length. China Point river access is located along the right bank of the river, at the U.S. Forest Service (USFS) river access just off Highway 96. One crew surveyed this reach, on the fourth day (Thursday) in approximately seven hours. Reach 5 was surveyed each week for five consecutive weeks.

Reach 6: China Point river access to the Indian Creek confluence (rkm 169.4; Figure 2).

Reach 6 is approximately 19.1 rkm (11.4 miles) in length. Due to the high concentration of redds in this area, this reach was split at Gordons Ferry river access (rkm 180.4). China Point river access to Gordons Ferry river access is approximately 7.2 rkm (4.5 miles). Gordons Ferry river access to Indian Creek confluence is approximately 11.5 rkm (7.1 miles). The Gordons Ferry river access is located just off Highway 96. This reach was split into two sections and covered by two crews on the fifth day (Friday) with each section taking approximately five hours to survey.

10 km Sections

In order to describe the frequency of spawning redd occurrence, in percentages, by yearly redd counts, the mainstem Klamath River between IGD and the confluence of Indian Creek was broken into 14 river sections approximately 10 rkm long.

Redd Data

The date, number of redds/site, location in channel, and redd site tally number were recorded on each flag. Flags were tied to the bank nearest the redd. A different color flagging was used each week to ensure that redds were not double counted during the course of the survey. Redd sites were also recorded on river maps and on data forms. Data recorded included: GPS mark number, tally number, location in channel (left or right bank, middle, side channel, split channel and pool tail-out), distance from bank, defended area (distance between redds in a cluster), number of adults and grilse, flag location, water temperature, weather conditions, river reach, and age of redd code.

Estimated redd ages were recorded as Redd Age Code 1, 2 or 3 depending on appearance. Fresh redds with bright substrate, little or no periphyton, and well-developed mounds were classified as Redd Age Code 1. Redds two to four weeks old with slightly flattened mounds and dulled substrate due to periphytonic growth were classified as Redd Age Code 2. Redds older than four weeks, which were identifiable only by pit and/or mound presence and typically could not be distinguished from surrounding substrate by brightness differences, were classified as Redd Age Code 3. Only completed redds (which included both a pit and mound) were included in the daily counts. Test redds and small (<1.0 m^2) redds were omitted.

Water Temperature

Water temperature was recorded using an Optic Stowaway Tidbit on an hourly basis throughout the survey period at the downstream end of R-Ranch (5.5 rkm downstream of IGD). Hourly data were used to calculate the mean daily water temperatures.

Discharge

Mean daily river flow was provided by the U.S. Geological Survey gaging station (Number 11516530), located in the Klamath River just downstream of IGD. Daily river flow was measured in cubic feet per second (cfs)

Water Clarity

A 20 cm diameter Secchi disc was used daily throughout the surveys to measure water clarity. Water clarity was measured by lowering a Secchi disc vertically into the water column. The disc was lowered until the black and white pattern on the disc was not discernable. The disc was then raised until the pattern was just vaguely discernable, and this depth was recorded in meters.

Adult Grilse Expansion

The total number of redds counted by AFWO during these surveys is used by California Department of Fish and Game (CDFG) to estimate adult and grilse (two year old) spawning abundance (Pisano 2001). Adult numbers were calculated by multiplying the total redd count by two. This estimate assumes there is only one male and female salmon per redd. The total number of grilse was estimated from length

frequency and scale analysis data.

RESULTS AND DISCUSSION

A total of 1,578 chinook salmon redds were counted between IGD and the confluence of Indian Creek, representing a 62.7% increase from the 1999 count of 989 (Table 1; Figure 3). Based on field maps and notes from the survey, locations of redds for all reaches surveyed are shown in Figures 4 to 7.

Reaches 1 to 6

Reach 1: IGD to Ash Creek river access.

A total of 788 redds were observed in this reach during the 2000 survey (Table 1; Figure 4). The 788 redds represent 49.9% of the total redd count for 2000. The redd density in this reach was 32.8 redds/rkm. Based on weekly redd counts, peak spawning occurred during Week 1 (Table 1).

Reach 2: Ash Creek river access to Beaver Creek Riffle river access.

A total of 208 redds were observed in this reach during the 2000 survey (Table 1; Figures 4 and 5). The 208 redds represent 13.2% of the total redd count for 2000. Redd density was 8.7 redds/rkm. Peak spawning (n=92) occurred during Week 1 of the survey (Table 1). The 208 redds counted in this reach represent the highest count since the project started in 1993 (Table 1).

Reach 3: Beaver Creek Riffle river access to Blue Heron river access.

A total of 196 redds were counted in this reach during the 2000 survey (Table 1; Figure 5). The 196 redds represent 12.4% of the total redd count for 2000. Redd density was 7.8 redds/rkm. Peak spawning (n=69) in Reach 3 occurred during both Weeks 1 and 3 (Table 1). The 196 redds observed during the survey is the second highest count for this reach since the project started in 1993.

Table 1. Weekly summary and percent frequency of mainstem Klamath River redd counts for Reaches 1 to 6, 1993 to 2000 (NS = No Survey).

Reach 1 Iron Gate Dam to Ash Creek River Access	Reach 2 Ash Creek River Access to Beaver Creek Riffle River Access	Reach 3 Beaver Creek Riffle to Blue Heron	Reach 4 Blue Heron River Access to Seiad Bar River Access	Reach 5 Seiad Bar River Access to China Point	Reach 6 China Point to Indian Creek River Access	Weekly Total	
Year	1993						
Week 1 Oct 25 to 29	15	13	30	18	16	81	173
Week 2 Nov 1 to 5	67	24	4	1	15	5	116
Week 3 Nov 8 to 12	5	1	18	7	0	1	32
Week 4 Nov 15 to 18	0	0	4	5	0	0	9
Total	87	38	56	31	31	87	**330**
% Frequency	26	12	17	9	9	26	
Year	1994						
Week 1 Oct 17 to 21	89	28	48	NS	NS	98	263
Week 2 Oct 24 to 28	278	59	77	113	98	124	749
Week 3 Oct 31 to Nov 4	375	20	46	42	16	33	532
Week 4 Nov 7 to 11	86	NS	NS	NS	NS	NS	86
Week 5 Nov 14 to 18	3	2	7	4	5	5	26
Total	831	109	178	159	119	260	**1656**
% Frequency	50	7	11	10	7	16	
Year	1995						
Week 1 Oct 16 to 20	138	12	70	26	30	139	415
Week 2 Oct 23 to 27	598	82	199	94	91	169	1233
Week 3 Oct 30 to Nov 3	727	58	78	35	57	112	1067
Week 4 Nov 6 to 10	277	26	49	13	25	50	440
Week 7 Nov 27 to Dec 1	39	9	14	4	12	3	81
Total	1779	187	410	172	215	473	**3236**
% Frequency	55	6	13	5	7	15	
Year	1996						

Week 1 Oct 21 to 25	290	31	96	10	118	39	584
Week 2 Oct 28 to Nov 1	291	29	25	22	42	92	501
Week 3 Nov 4 to 8	83	4	24	8	33	59	211
Week 4 Nov 11 to 15	40	0	6	0	7	23	76
Total	704	64	151	40	200	213	**1372**
% Frequency	51	5	11	3	15	16	

Table 1 (continued). Weekly summary and percent frequency of mainstem Klamath River redd counts for

Reaches 1 to 6, 1993 to 2000 (NS = No Survey).

	Reach 1 Iron Gate Dam to Ash Creek River Access	Reach 2 Ash Creek River Access to Beaver Creek Riffle River Access	Reach 3 Beaver Creek Riffle to Blue Heron	Reach 4 Blue Heron River Access to Seiad Bar River Access	Reach 5 Seiad Bar River Access to China Point	Reach 6 China Point to Indian Creek River Access	Weekly Total
Year	1997						
Week 1 Oct 16	272	NS	NS	NS	NS	NS	272
Week 2 Oct 20 to 24	252	37	69	89	29	136	612
Week 3 Oct 27 to 31	424	18	76	52	22	76	668
Week 4 Nov 3 to 7	70	7	13	16	8	27	141
Week 5 Nov 10 to 14	2	14	4	5	3	18	46
Total	1020	76	162	162	62	257	**1739**
% Frequency	59	4	9	9	4	15	
Year	1998						
Week 1 Oct 14 to 15	89	NS	NS	NS	NS	NS	89
Week 2 Oct 19 to 23	180	45	67	15	20	45	372
Week 3 Oct 26 to 30	368	11	12	14	7	39	451
Week 4 Nov 2 to 6	226	22	33	10	9	28	328
Week 5 Nov 9 to 12	135	3	11	3	2	2	156
Week 6 Nov 15 to 19	12	1	3	0	1	2	19
Total	1010	82	126	42	39	116	**1415**
% Frequency	71	6	9	3	3	8	
Year	1999						
Week 1 Oct 13 to 15	98	3	NS	NS	NS	NS	101
Week 2 Oct 18 to 22	200	27	31	17	23	39	337

Week 3 Oct 25 to 27	304	23	20	NS	NS	NS	347
Week 4 Nov 1 to 5	83	12	9	8	8	19	139
Week 5 Nov 8 to 12	37	2	2	1	5	11	58
Week 6 Nov 15 to 19	1	2	0	2	2	0	7
Total	723	69	62	28	38	69	**989**
% Frequency	73	7	6	3	4	7	

Table 1 (continued). Weekly summary and percent frequency of mainstem Klamath River redd counts for

Reaches 1 to 6, 1993 to 2000 (NS = No Survey).

	Reach 1 Iron Gate Dam to Ash Creek River Access	Reach 2 Ash Creek River Access to Beaver Creek Riffle River Access	Reach 3 Beaver Creek Riffle to Blue Heron	Reach 4 Blue Heron River Access to Seiad Bar River Access	Reach 5 Seiad Bar River Access to China Point	Reach 6 China Point to Indian Creek River Access	We ekl y To tal
Year	2000						
Week 1 Oct 16 to 20	327	92	69	25	10	19	542
Week 2 Oct 23 to 27	146	62	34	52	10	53	357
Week 3 Oct 30 to Nov 3	254	42	69	54	20	86	525
Week 4 Nov 6 to 10	57	12	15	21	2	16	123
Week 5 Nov 13 to 17	4	0	9	12	0	6	30
Week 6 Nov 20 to 22	1	NS	NS	NS	NS	NS	1
Total	788	208	196	164	42	180	**1578**
% Frequency	50	13	12	10	3	11	

Figure 3. Yearly USFWS chinook salmon redd counts, 1993 to 2000.

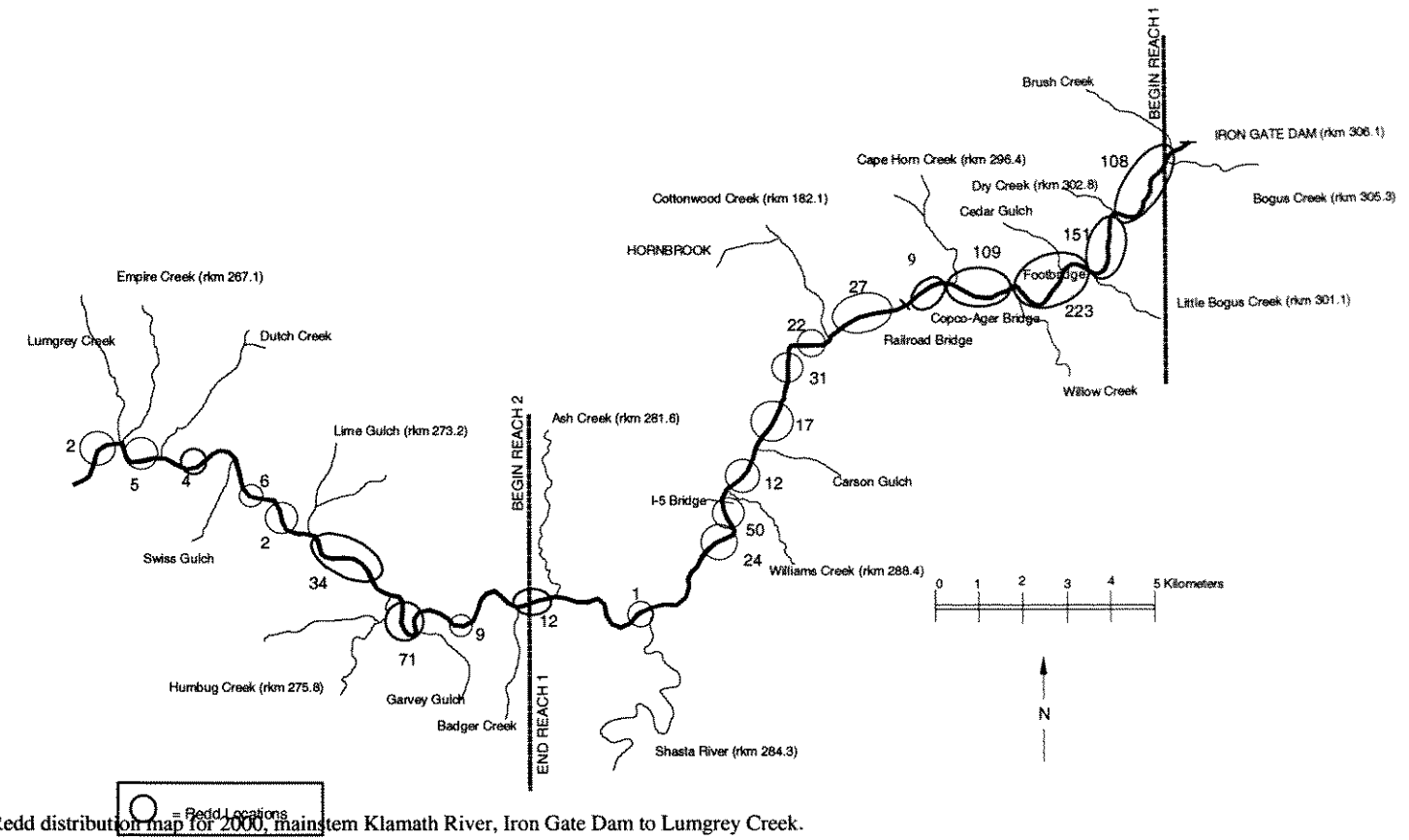

Figure 4. Redd distribution map for 2000, mainstem Klamath River, Iron Gate Dam to Lumgrey Creek.

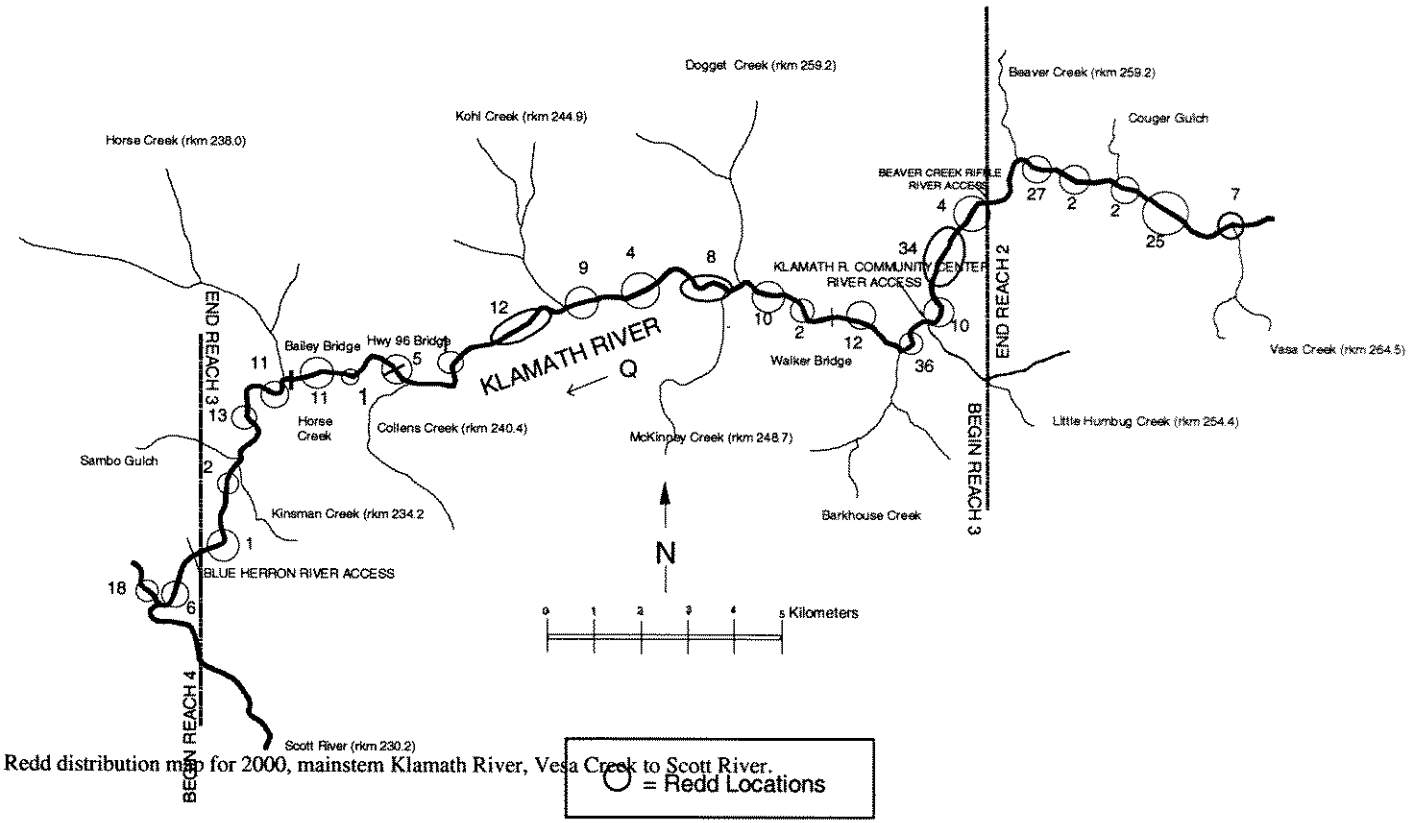

Figure 5. Redd distribution map for 2000, mainstem Klamath River, Vesa Creek to Scott River.

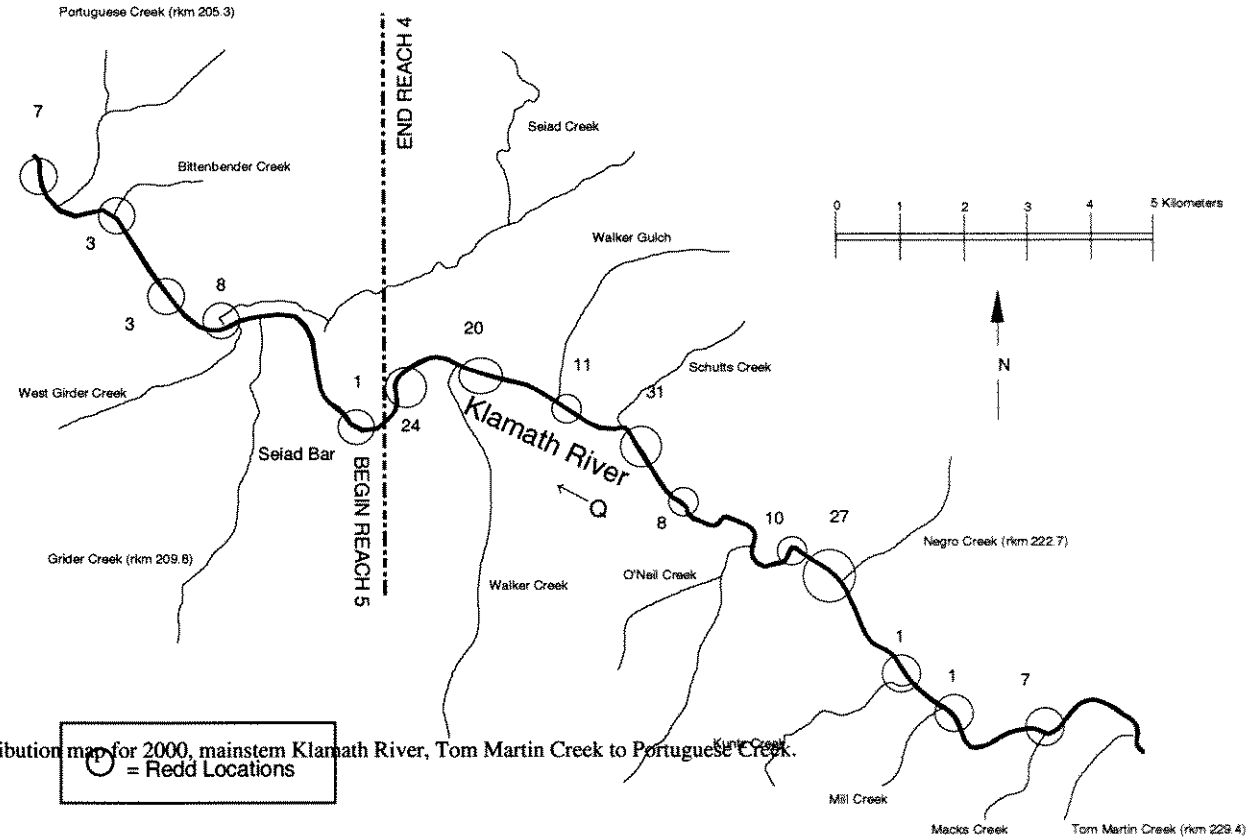

Figure 6. Redd distribution map for 2000, mainstem Klamath River, Tom Martin Creek to Portuguese Creek.

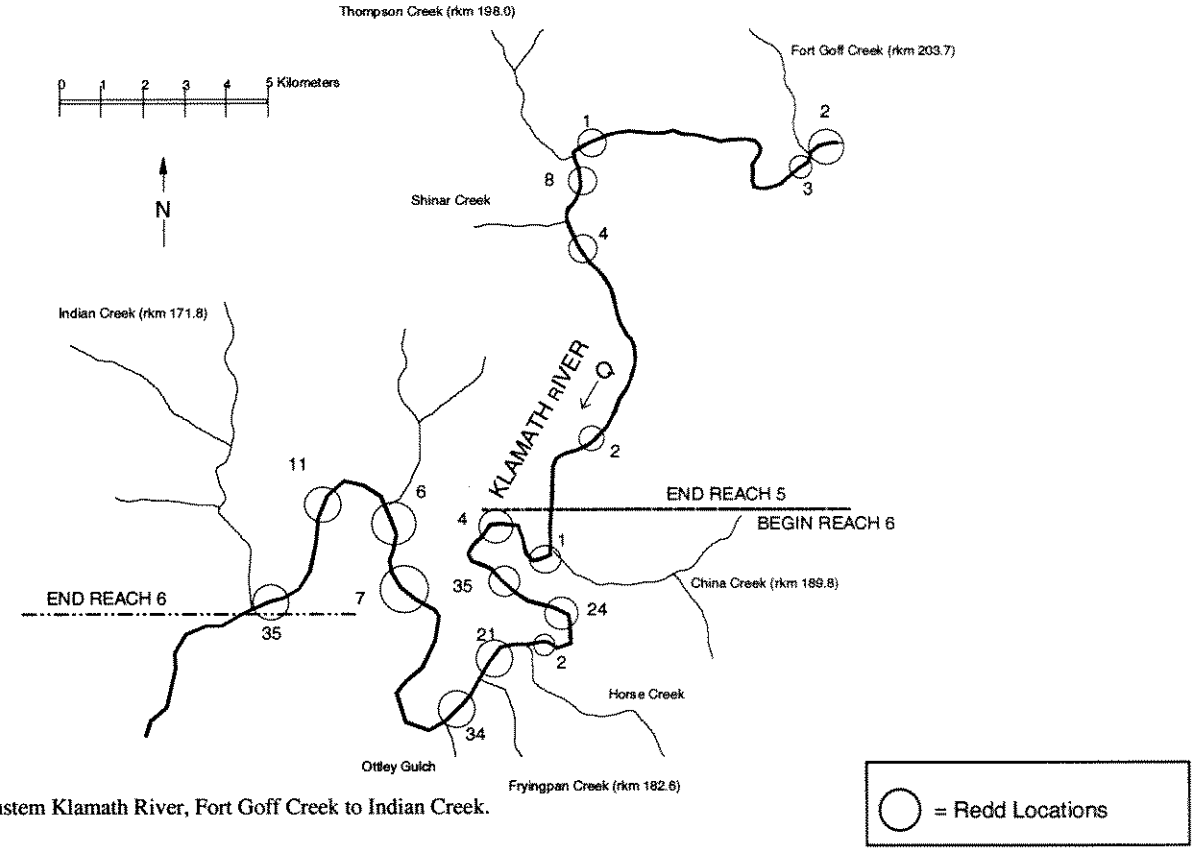

Figure 7. Redd distribution map for 2000, mainstem Klamath River, Fort Goff Creek to Indian Creek.

Reach 4: Blue Heron river access to Seiad Bar river access.

A total of 164 redds were counted in this reach during the 2000 survey (Table 1; Figures 5 and 6). The 164 redds represent 10.4% of the total redd count for 2000. Redd density was 8.6 redds/rkm. Peak spawning (n=54) in Reach 4 occurred during Week 3. The 164 redds observed during the survey is the second highest count for this reach since the project started in 1993.

Reach 5: Seiad Bar river access to China Point river access.

A total of 42 redds were counted in this reach during the 2000 survey (Table 1; Figures 6 and 7). The 42 redds represent 2.7% of the total redd count for 2000. Redd density was 1.8 redds/rkm. Peak spawning occurred during Week 3 (n=20) of this survey. Reach 5 had the lowest redd count of any reach sampled in 2000 (Table 1).

Reach 6: China Point river access to Indian Creek.

A total of 180 redds were counted in Reach 6 (Table 1; Figure 7). The 180 redds represent 11.4% of the total redd count for 2000. This represents a redd density of 9.5 redds/rkm and the fifth highest redd count for this reach since the beginning of this study. Peak spawning (n=86) in Reach 6 occurred during Week 3 (Table 1).

Spawning was observed throughout the mainstem river from IGD to Indian Creek and was consistent with previous survey data in that spatial distribution of redds is highest in the upper mainstem (IGD to Ash Creek river access). The highest weekly redd count occurred during Week 1 with Week 3 having the second highest count. Reach 5 had the lowest redd count (n=42) of any reach sampled in 2000 (Table 1).

10 km Sections

The 2000 redd counts were highest between IGD and Cape Horn Creek (Copco-Ager Bridge) with a redd density of 59.1 redds/rkm. The redd frequencies in this section increased from 24.2 to 60.9% during 1993 to 1999, but decreased to 37.5% in 2000 (Table 2; Figure 8). A very similar trend appears for the section between Cape Horn Creek and the Shasta River confluence (Table 2). Combined, these two upper mainstem sections account for 50% of the 2000 total redd count with the remaining 50% of the redds distributed between Shasta River and Indian Creek (Table 2). The lowest redd densities (0.7 redds/rkm) of any 10 rkm section were between Shinar Creek and China Creek.

Redd Data

Single and multiple redd clusters were predominately located by the left bank (31.1%), followed by the right bank (30.1%), mid channel (7.7%), side channels (29.6%), and unrecorded (1.5%).

Water Temperature

Mean daily water temperatures decreased from 15 to 8°C during this survey (October 16 and November 22, respectively). Water temperatures continued to decrease during these surveys even though IGD flows remained fairly stable 1,320 to 1,340 cfs (Figure 9).

Table 2. Percent redd frequency by 10 rkm (approximate) section on the mainstem Klamath River, 1993 to 1999.

TRIBUTARY REACH (rkm)	REACH DISTANCE (rkm)	PERCENT FREQUENCY							
		1993	1994	1995	1996	1997	1998	1999	2000
Iron Gate (306.1) to Cape Horn Ck (269.4)	10	24.2	38.9	39.1	40.9	45.0	55.1	60.9	**37.5**
Cape Horn Ck (269.4) to Shasta River (284.3)	12	2.1	11.1	15.6	10.6	14.2	16.1	11.7	**12.5**
Shasta River (284.3) to Humbug Ck (275.8)	9	2.7	1.1	1.9	0.8	1.1	3.0	3.3	**5.8**
Humbug Ck (275.8) to Vesa Ck (264.5)	11	5.5	2.2	1.1	1.1	1.8	1.6	2.9	**3.5**
Vesa Ck (264.5) to Little Humbug Ck (254.4)	10	5.8	6.9	5.2	4.8	3.3	3.0	2.9	**7.5**
Little Humbug Ck (254.4) to Kohl Ck (244.9)	10	7.9	3.4	4.9	3.3	4.3	3.0	0.9	**5.1**
Kohl Ck (244.9) to Kinsman Ck (234.2)	11	7.9	2.7	4.9	4.2	2.3	4.3	3.3	**3.6**
Kinsman Ck (234.2) to Kuntz Ck (224.4)	10	2.4	4.2	1.2	2.4	0.9	0.4	1.2	**2.1**
Kuntz Ck (224.4) to Walker Ck (214.4)	10	6.4	5.6	3.8	1.8	8.6	2.5	1.9	**6.8**
Walker Ck (214.4) to Portuguese Ck (205.3)	9	7.6	5.2	3.9	5.5	1.0	1.0	2.1	**2.5**
Portuguese Ck (205.3) to Shinar Ck (199.0)	10	1.2	3.9	2.2	3.1	1.4	1.4	1.6	**1.3**
Shinar Ck (199.0) to China Ck (189.8)	9	6.7	2.2	4.4	6.0	1.8	0.4.	0.3	**0.4**
China Ck (189.8) to Ottley Gulch (181.1)	9	12.4	7.1	6.0	10.7	6.5	4.7	3.6	**7.5**
Ottley Gulch (181.1) to Indian Ck (171.3)	10	7.3	5.4	5.8	4.8	7.6	3.5	3.0	**3.9**

Discharge

During this survey, mean daily river discharge at IGD ranged from 1,320 to 1,340 cfs (Figure 9). While during the 1999 survey, mean daily discharges were some of the highest (1,360 to 1,820 cfs). With some of the lowest occurring during 1994 (906 to962 cfs).

Water Clarity

Vertical Secchi disc readings ranged from 1.2 to 2.0 m during this survey compared to 1.5 to 2.7m in 1999. The 1.2 m reading was observed on October 24 in Reach 1. The 2.0 m reading was observed on November 2 in Reach 5. Although flows from IGD were relatively stable, water clarity was generally lower than in previous survey years. Water clarity generally decreased with higher river discharge, cloud cover, and precipitation.

Figure 8. Percent frequency of redds by year (1993 to 2000) from Iron Gate Dam to Cape Horn Creek.

Figure 9. Water temperatures (C) at rkm 300.4 and discharge from Iron Gate Dam (October 16 to November 22).

Suction Dredge Mining

Recreational suction dredge mining was present throughout the survey from the I-5 Bridge to Happy Camp. There was only two redd observed this year on suction dredge tailings. Studies have indicated that redds constructed on dredge tailings are more unstable in high flows than those on naturally deposited substrate (Harvey and Lisle 1999).

Adult Grilse Expansion

The CDFG estimated the natural fall chinook spawner escapement for the mainstem Klamath River for 2000 at 3,182 adults and 273 grilse (Table 3). The adult/grilse estimates are based on male to female ratio and jack percentages observed at upper Klamath River tributary weirs (Pisano 2001).

Table 3. Natural fall chinook spawning escapement adult and grilse expansion, Klamath River, 2000 (Pisano 2001).

Natural Spawning Area	Grilse	Adults	Totals
Salmon River Basin	250	1,522	1,772
Scott River Basin	556	5,697	6,253
Shasta River Basin	1,597	10,699	12,296
Bogus Creek Basin	252	34,799	35,051
Mainstem Klamath River	273	3,182	3,455
Misc. Klamath River tributaries	122	1,381	1,503
Total Natural Spawners	3,050	57,280	60,330

Based on spawning data from mainstem and tributary spawning surveys conducted by AFWO, USFS, CDFG, and Hoopa and Yurok tribes, the CDFG estimated that 181,141 adults spawned in-river or at hatcheries within the Klamath River Basin. This high escapement is similar to that of 1995 (n=190,721).

SUMMARY

The fall chinook redd count of 1,578 was the fourth highest number observed since the initiation of these surveys in 1993 when 330 redds were counted. The highest redd count was 3,240 redds observed in 1995. Since 1993, the tendency for chinook to spawn in the upper 10 rkm between IGD and Cape Horn Creek increased to 60.9 but declined in 2000 to 37.5

Peak mainstem chinook spawning occurred during Week 1 (October 16 to 20) in the area between IGD and Beaver Creek river access (Reach 1 and 2). Reach 3 (Beaver Creek to Blue Heron river access) peaked (n=69) during Week 1 and 3 (October 30 to November 3). All reaches downstream of Blue Heron river access (Reaches 4 to 6) peaked during Week 3.

Water Clarity during this years survey was some of the lowest (1.0 to 2.0 m) observed during this study. Low water clarity may have attributed to limited redd identification and counts.

The age composition of the 2000 mainstem spawners consisted primarily of three year old fish (1997 brood year) (Pisano 2001).

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